

## REMARKS

Claims 1-14 are pending in this application. Claims 1-14 stand rejected under 35 USC 102(a) as anticipated by, or in the alternative, under 35 USC 103(a) as obvious over Maloney '200B1, Stecura, Jacobsen, Watanabe '138, Pitts '500, Kondo '330 or DE 4302167.

As the Examiner has noted, the Maloney reference describes a gadolinia-zirconia oxide. However, claims 1-9 of the present invention are directed to yttria stabilized zirconia, and claims 10-14 of the present invention are directed to stabilized hafnia. The teachings of Maloney related to gadolinia-zirconia are not relevant to the present claims. Maloney does mention yttria in column 10, lines 17-19, where he says that either the zirconia or the gadolinia may be partially substituted with yttria. However, Maloney actually teaches away from claims 1-9 by stating that the yttria may be used "up to about 25 mol. % and preferably only up to about 20 mol. %." Thus, Maloney fails to support the rejection of any of the present claims under either 35 USC 102 or 35 USC 103.

As the Examiner has noted, Stecura describes a composition of zirconia with up to 25% ytterbia. However, the present claims are not directed to a ytterbia-containing material. More relevant to the present invention, Stecura also describes a composition of zirconia with up to 25% yttria. That teaching of Stecura fails to anticipate the present invention since the present claims 1-9 are directed to zirconia coating materials that contain more than 25% yttria, and claims 10-14 are directed to hafnia coating materials. Furthermore, Stecura provides no motivation to increase the concentration of yttria to more than 25%, since as indicated in the figure, an increasing concentration of yttria has the adverse consequence of reducing the number of cycles to failure that the material can endure. Thus, Stecura actually teaches away from trying the very high concentrations of stabilizer claimed in the present invention because the data up to 25% yttria indicates that higher concentrations would yield unacceptably low thermal cycle lifetimes. Stecura has failed to recognize the

chang in properties that can occur at even higher stabilizer concentrations when the oxygen vacancies within a ceramic matrix structure begin to form multi-vacancies (see page 5, line 26 through page 6, line 4 of the present specification). Finally, Stecura does not even mention hafnia, which is one of the limitations of claims 10-14. Thus, Stecura fails to support the rejection of any of the present claims under either 35 USC 102 or 35 USC 103.

As the Examiner has noted, Jacobson describes a concentration of stabilizer of only 1-15%. The present independent claims do not contain numerical stabilizer concentration values, however, they do contain other limitations that cannot be ignored under 35 USC 102 or 103. The materials of Jacobson that contain only up to 15% stabilizer fail to teach or suggest these limitations: e.g. the claim 1 limitation of a concentration of yttria greater than that concentration which would result in a peak ionic conductivity of the matrix; and the claim 5 limitation of a concentration of yttria that is sufficiently high to create a quantity of multi-vacancy defect clusters such that the material exhibits the claimed resistance to sintering. These limitations can be satisfied only by a material having a concentration of stabilizer that is above 15%, as demonstrated by the information in FIG. 2 of the present specification. Dependent claims provide specific limitations that are in excess of the 15% taught by Jacobson. Furthermore, Jacobson is silent with regard to the hafnia limitation of claims 10-14. Not only does Jacobson fail to teach each of the limitations of the present claims under 35 USC 102, he also provides no motivation for increasing the stabilizer concentration to beyond 15%, since in column 5, lines 44-50 Jacobson is discussing only the range of 1-15%, with the lower values in the range used if the tetragonal form is desired and the higher concentrations (i.e. up to the 15% described) used if a cubic form is desired. Thus, Jacobson fails to support the rejection of any of the present claims under either 35 USC 102 or 35 USC 103.

As noted by the Examiner, Watanabe recognizes the physical fact that a cubic system is formed at 16 mol. % or more. However, Watanabe teaches away from using such a material by specifying that the "proportion of the stabilizer in the component A is no more than 14 mol. %." This value is specified

to be certain to stay below the 16% value wherein the cubic system is primarily formed. Thus, Watanabe teaches away from not only the high concentration of stabilizer, but also teaches away from the limitation of a cubic matrix structure. Furthermore, Watanabe fails to describe the  $\text{Gd}_2\text{O}_3$  stabilized  $\text{HfO}_2$  material of claims 11-14. Thus, Watanabe fails to support the rejection of any of the present claims under either 35 USC 102 or 35 USC 103.

Pitts fails to describe any of the claimed materials. Pitts describes an impure yttria concentrate containing only 35-70% by weight of yttria. These percentages should not be confused with the concentration of yttria claimed in the stabilized zirconia thermal barrier coatings of claims 1-9. The impure yttria concentrate is used to stabilize zirconia, and the resulting material contains a total of only "at least 3 mole% of yttria and heavy rare earth metal oxides in the zirconia body". (column 3, lines 28-29 of Pitts) Thus, Pitts fails to anticipate or suggest a thermal barrier coating having the much higher levels of yttria that are included in the limitations of claims 1-9. Furthermore, Pitts does not even discuss the stabilized hafnia material of claims 10-14. Thus, Pitts fails to support the rejection of any of the present claims under either 35 USC 102 or 35 USC 103.

Kondo describes a zirconia ingot material that is used as a target for an energy beam for generating zirconia vapor in a vapor deposition process. The concentration of stabilizer in the target material is from 0.1-40 wt.%. However, Kondo fails to describe the concentration of stabilizer that will exist in the resulting vapor-applied coating material. It is well known in the art that the weight percent concentrations of constituents of the target material are not directly related to the concentration of the constituents in the deposited coating, since other variables such as the melting temperatures of the constituents, the relative rates of evaporation of the constituents, the degree of isothermal conditions, feed rates into the melt pool, beam power affect evaporation rates, the vapor pressures of the constituents, and the absolute pressure are intervening factors that affect the chemistry of the deposited material. Thus, by simply describing a target ingot having a high concentration of stabilizer, Kondo fails to describe the

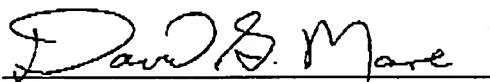
zirconia thermal barrier coating material of claims 1-9. Furthermore, Kondo does not even mention the hafnia material limitation of claims 10-14. Thus, Kondo fails to support the rejection of any of the present claims under either 35 USC 102 or 35 USC 103.

DE 4302167 describes sputtering targets, not a deposited thermal barrier coating. Furthermore, this reference teaches away from the present invention by describing stabilizer only up to 25 wt. %. As discussed above, even the present independent claims that do not include a specific numerical value for the concentration of stabilizer are necessarily limited to materials having stabilizer concentrations in excess of 25 wt. % in accordance with the teaching of the specification. Certain dependent claims provide additional specific weight percent limitation values that are higher than the teaching of this reference. Finally, DE 4302167 fails to describe the hafnia material limitation of present claims 10-14. Thus, DE 4302167 fails to support the rejection of any of the present claims under either 35 USC 102 or 35 USC 103.

The applicants are uncertain why the Examiner cites Subramanian EP 1318215, since that application is one of the family of foreign applications claiming priority from the present U.S. application. Thus, EP 1318215 is not prior art as to the present application.

Reconsideration of the application in light of the above Remarks and allowance of claims 1-14 are respectfully requested.

Respectfully submitted,



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